ACES-Based Testbed and Bayesian Game-Theoretic Framework for Dynamic Airspace Configuration, Phase I

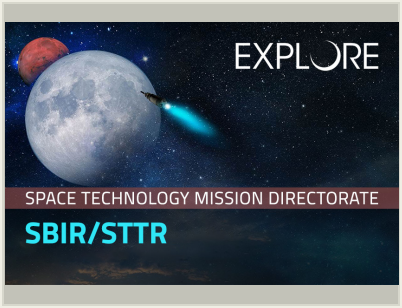
Completed Technology Project (2009 - 2009)

Project Introduction

The key innovation in this effort is the development of algorithms and a framework for automated Dynamic Airspace Configuration (DAC) using a cooperative Bayesian game framework. Given an initial sector plan, we propose an approach for dynamic re-sectorization in which boundaries can be redefined in response to changing demand, weather or other user preferences. Advantages of this approach are that it models the human coordination process, provides a rich domain independent framework for modeling collaboration and a theoretical framework to analyze issues related to convergence, decision-making complexity and stability. The communicative aspects of the game-framework also make it well suited for an agent-based implementation. In this agent-based implementation, each agent represents a player (Sector ATC/TMC) in the air traffic domain. Sector ATC's collaborate with neighboring Sector ATC's within the current sector, and across center boundaries to "collapse", "split" or borrow airspace to optimize traffic flow. The players engage in an "automated collaborative negotiation search" with each other to determine sector geometries that will optimize the overall airspace efficiency. We propose to implement DAC algorithms in Cybele's Decision Support System Infrastructure and demonstrate feasibility using NASA's ACES software.

Anticipated Benefits

In addition to NASA applications the proposed agent-based game theoretic has several applications in DOD strategic and tactical planning warfare scenarios where joint forces are teaming against red forces. The proposed framework has direct application to DOD and FAA SUA management in terms dynamically changing SUA structure to optimize SUA utilization, en-route capacity, controller workload and overall all delay. Our initial target for the product developed in this effort is the NextGen airspace design, modeling and simulation community within NASA and FAA. The proposed approach and testbed will provide a unique capability to model and simulate DAC concepts.



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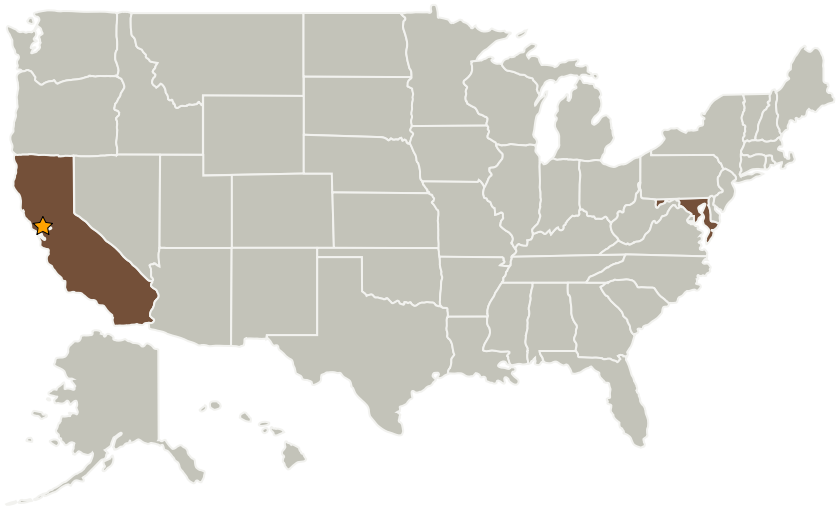
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Intelligent Automation, Inc.	Supporting Organization	Industry	Rockville, Maryland

Primary U.S. Work Locations	
California	Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Larry Meyn

Principal Investigator:

Goutam Satapathy

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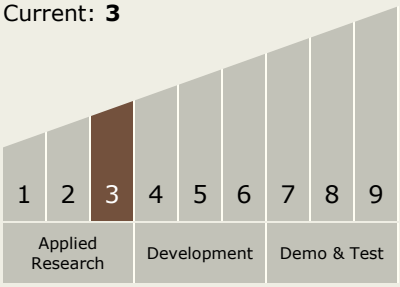
Completed Technology Project (2009 - 2009)

Technology Maturity (TRL)

Start: **3**
Current: **3**



Technology Areas

Primary:

- TX16 Air Traffic Management and Range Tracking Systems
  - TX16.3 Traffic Management Concepts